

Revision of *Tricholepis* DC. (Asteraceae) in India

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Abstract

The genus *Tricholepis* with 10 species and one variety in India is revised. Out of these, four taxa viz., *T. amplexicaulis*, *T. glaberrima* var. *glaberrima*, *T. glaberrima* var. *angustifolia* and *T. radicans* are endemic to India. A key to the section of the genus and species, taxonomic descriptions and illustrations are provided along with data on phenology, distribution, ecology and uses. Four species namely, *T. chaetolepis*, *T. montana*, *T. nakaoi* and *T. stewartei* are excluded in the present work.

INTRODUCTION

Tricholepis, a genus of herbaceous or shrubby plants characterised by entire to pinnatifid leaves, terminal, no-rayed heads with red, purple or yellow florets and flat or turgid, smooth or striated achenes with or without pappus, was originally established by De Candolle (1838) recognising five species in it. Subsequently, several additions were made by authors like Dalzell and Gibson (1861), Kurz (1872), C.B. Clarke (1876), Lincz (1954), Dunn (1921), Kitamura (1964), Rechinger (1980) and Dittrich (1993) taking the total number of species to 18, distributed in Afghanistan, India, Pakistan, Nepal, Bhutan, Myanmar, Thailand, Iran and Tadjikistan (Bremer, 1994).

The earliest comprehensive taxonomic treatment of the Indian representatives of the genus was made by C.B. Clarke (1876), wherein he described 12 species, of which *T. nigrescens* Edgew., *T. spartoides* Clarke and *T. procumbens* Wt. have since then been reduced to the synonymy of *T. furcata* DC., *T. chaetolepis* (Boiss.) Rech. f. and *Amberboa ramosa* (Roxb.) Jafri respectively. Subsequently, J.D. Hooker, in his *Flora of British India* (1881) described 10 species of the genus keeping *T. montana* Dalz. & Gibs. and *T. royeli* Hook.f. under doubtful and imperfectly known species. Since then, no intensive taxonomic studies have been done on this genus. Recently Rao *et al.* (1988) listed 12 species and however, Hajra (1995) recorded only 10 species from present day India, but they have not included *T. toppinii*, a species described by Dunn as early as in 1921 from Kashmir. Chaudhary and Pandey (1995) have discussed the taxonomic significance of phyllaries and achenes of 13 species of *Tricholepis* and

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have provided a key based on these traits. Recently, Chaudhary (1998) has reinstated *T. toppinii* as a distinct species and given a detailed account of 4 species of *Tricholepis* (viz., *T. chaetolepis*, *T. nakaoi*, *T. tibetica* and *T. toppinii*).

We have been studying the genus in India for the last several years. Apart from our own field studies and collections, we have also studied specimens of the genus in the various herbaria (K, BM, CAL, BSD, DD, BSI, LWG, BHAG). Based on our observations, we have reduced *T. angustifolia* as a variety of *T. glaberrima* (Chaudhary & Pandey, 1994). In the present study, we have excluded *T. chaetolepis*, *T. montana*, *T. nakaoi* and *T. stewartei* from Indian flora in the absence of any authentic specimens and resurrected *T. roylei* Hook. f. after studying specimens from Indian Himalaya and Tibet. So, as it stands, at present there are 10 species and one variety of the genus within the political boundaries of present day India, falling under the three sections of *Tricholepis* viz., sect. *Tricholepis*, sect. *Ochanopappus*, and sect. *Stictophyllum* concentrated mainly in the NW Himalayas and Peninsular India. Most of the species grow in grasslands along hill slopes. Some of them (e.g., *T. glaberrima*, *T. radicans*), however, run wild in the fallow lands near agricultural fields, while *T. stictophyllum* in open places and in *Shorea* forests. *T. amplexicaulis* and *T. radicans* are used by the local people in the treatment of leucoderma and other skin afflictions, fever and inflammations (Caius, 1940).

Key to the Sections of *Tricholepis*

- 1a Corolla creamy, light yellow or yellow; pappus not or slightly flattened below
.....sect. *Tricholepis*
- b Corolla red or purple; pappus flattened below or absent 2
- 2a Pappus hairs scabrid sect. *Ochanopappus*
- b Pappus hairs feathery sect. *Stictophyllum*

Constituent Indian taxa of different Sections of *Tricholepis*

Section *Tricholepis* DC.

- 1. *T. karenium*
- 2. *T. furcata*
- 3. *T. elongata*
- 4. *T. roylei*

Section *Ochanopappus* C.B. Clarke

- 5. *T. radicans*
- 6. *T. amplexicaulis*
- 7. *T. glaberrima* var. *glaberrima*
- 8. *T. glaberrima* var. *angustifolia*
- 9. *T. tibetica*
- 10. *T. toppinii*

Section *Stictophyllum* C.B. Clarke

- 11. *T. stictophyllum*

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TAXONOMY

Tricholepis DC. in Guill., Arch. Bot. 2: 515. 1833 & Prodr. 6: 563. 1838; Benth. in Benth. & Hook. f., Gen. Pl. 2: 475. 1873; Clarke, Compo. Ind. 237. 1876; Hook. f., Fl. Brit. India 3: 379. 1881. Rechinger, Fl. Iranica 139b:303. 1980; Bremer, Asteraceae. 156.1994; Hajra in Hajra *et al.*, Fl. India 12 : 220.1995.

Stictophyllum Edgew., Trans. Linn. Soc. 20: 78. 1846.

Annual or perennial, erect herbs or shrubs branched or unbranched glabrous to pubescent. Leaves simple, sessile or petioled, entire to pinnatifid, often with raised dots on the surface. Capitulum terminal, solitary, peduncled, homogamous, erect or rarely noded, ovoid, obovate or oblong-cylindrical; phyllaries multiseriate, unequal, shorter in outer whorls, usually with long points, glabrous to pubescent, sometimes densely ciliate along margins. Disc florets bisexual, similar, creamy, yellow, red or purple, regular or suboblique; tube slender, 5-lobed to the middle; stamens 5, filaments glabrous or papillose-hairy; anthers connate, sagittate at base, acute at apex; style slender, bifid at apex. Achenes glabrous, oblong or ovoid, smooth or ribbed, turgid or flat, basal areole lateral, terminal areole small or broad, with or without pappus; pappus unequal, multiseriate, scabrid or feathery.

Key to the species and varieties

- 1a. Corolla red or lilac 2
- b. Corolla creamy, light yellow or yellow 8
- 2a. Achenes without pappus and obtuse at apex 1. *T. amplexicaulis*
- b. Achenes with minute to very long pappus and truncate at apex 3
- 3a. Pappus longer than achenes 4
- b. Pappus shorter than achenes 6
- 4a. Plants with short stem; leaves generally narrowly oblong, 2-11 x 0.4-1.3 cm; outer phyllaries oblong-ovate with acuminate tip, inner phyllaries flexuous at tip; pappus feathery with long hairs 8. *T. stictophyllum*
- b. Plants with well-developed stem; leaves generally linear, up to 4 x 0.2 cm; outer phyllaries triangular, filiform or linear with more aristate tip, inner phyllaries straight or curved at tip; pappus barbellate 5
- 5a. Outer phyllaries triangular with acute tip, ca 1 mm long 9. *T. tibetica*
- b. Outer phyllaries filiform or linear with more aristate tip, 3-8 mm long 10. *T. toppinii*
- 6a. Achenes distinctly ribbed, turgid, with minute to 3.5 mm long pappus 6. *T. radicans*
- b. Achenes smooth or faintly striate, flat, with very minute to 2 mm long pappus 7
- 7a. Outer phyllaries glabrous and inner phyllaries pubescent; basal areole lateral but not distinctly oblique 4a. *T. glaberrima* var. *glaberrima*
- b. All phyllaries glabrous; basal areole lateral and distinctly oblique 4b. *T. glaberrima* var. *angustifolia*
- 8a. Achenes angled; pappus deciduous 9
- b. Achenes rounded; pappus persistent 10

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- 9a. Outer phyllaries narrowly-ovate with more acuminate tip, glabrous 2. *T. elongata*
 b. Outer phyllaries filiform with broad base, sparsely to densely ciliate with upwardly spreading hairs towards tip 3. *T. furcata*
 10a. Outer phyllaries glabrous 7. *T. roylei*
 b. Outer phyllaries densely ciliate 5. *T. karensium*

1. *Tricholepis amplexicaulis* Clarke, Compos. Ind. 240. 1876; Hook. f., Fl. Brit. India 3: 381. 1881; Gamble, Fl. Pres. Madras 2: 511. 1957 (rep.ed.); Cooke, Fl. Pres. Bombay 2: 115. 1958 (rep. ed.); Santapau, Rec. Bot. Surv. India 16:136.1967; Rao *et al.*, Fl. Indicae Enum.-Aster. 84.1988; Chaudhary & Pandey, Rheede 4 : 41, f. 1. 1994; Hajra in Hajra *et al.*, Fl. India 12: 220.1995 (Fig.1).

T. radicans DC., Prodr. 6 : 564. 1838, p.p.

Annual, erect herbs or shrubs, up to 150 cm high; branches terete to ridged, glabrous. Leaves sessile, alternate, 3.5 - 17 x 0.5 - 4.5 cm, reducing in size towards the apex; obovate, linear-obovate, oblong-obovate or occasionally elliptic, amplexicaul (in lower leaves) or obtuse (in upper leaves) at base, serrate with mucronate teeth along entire margin or serrate to incised towards base and entire towards apex, acute to acuminate and mucronate at apex; glabrous, minute hairs present along margin; black protuberances present on the surface; midrib and lateral veins raised below, lateral veins 3-13 pairs, curving towards margin. Capitulum 2.0-2.5 x 1.5-2.5 cm, terminal or occasionally axillary, solitary or very rarely paired, sessile to shortly peduncled, ovoid-campanulate, truncate or rarely obtuse at base; peduncles 0-2.3 cm long, rigid, glabrous; phyllaries 7-16 x 0.5-1.0 mm, subequal, shorter in outer whorls, tightly appressed, spreading and deflexed at tip, linear or linear ovate, entire along margin, caudate to aristate at apex, glabrous towards base, finely pubescent towards apex. Corolla pink, purple or lilac. Achenes 5-6 x 1.2-2.2 mm, oblong, compressed, smooth or very faintly striate, glabrous, bluish-brown; pappus absent.

Type : Karnataka, "Canara and Mysore", Law s.n. (Lectotype - CAL, designated here).

Phenology : Flowering from October through December (-January).

Distribution : India (Gujarat, Karnataka, Kerala, Maharashtra) - endemic.

Ecology : In grasslands on hill slopes; alt. 200-1350 m.

Uses : The plant is used in the treatment of leucoderma and skin diseases, and in inflammation (Indraji, 1910).

Note : J.D. Hooker (1881) has recorded one variety of the species ("var. β " - without name) based on leaf shape and size. However, during the present investigation great variations in these characters have been observed and therefore did not recognise any infraspecific taxa.

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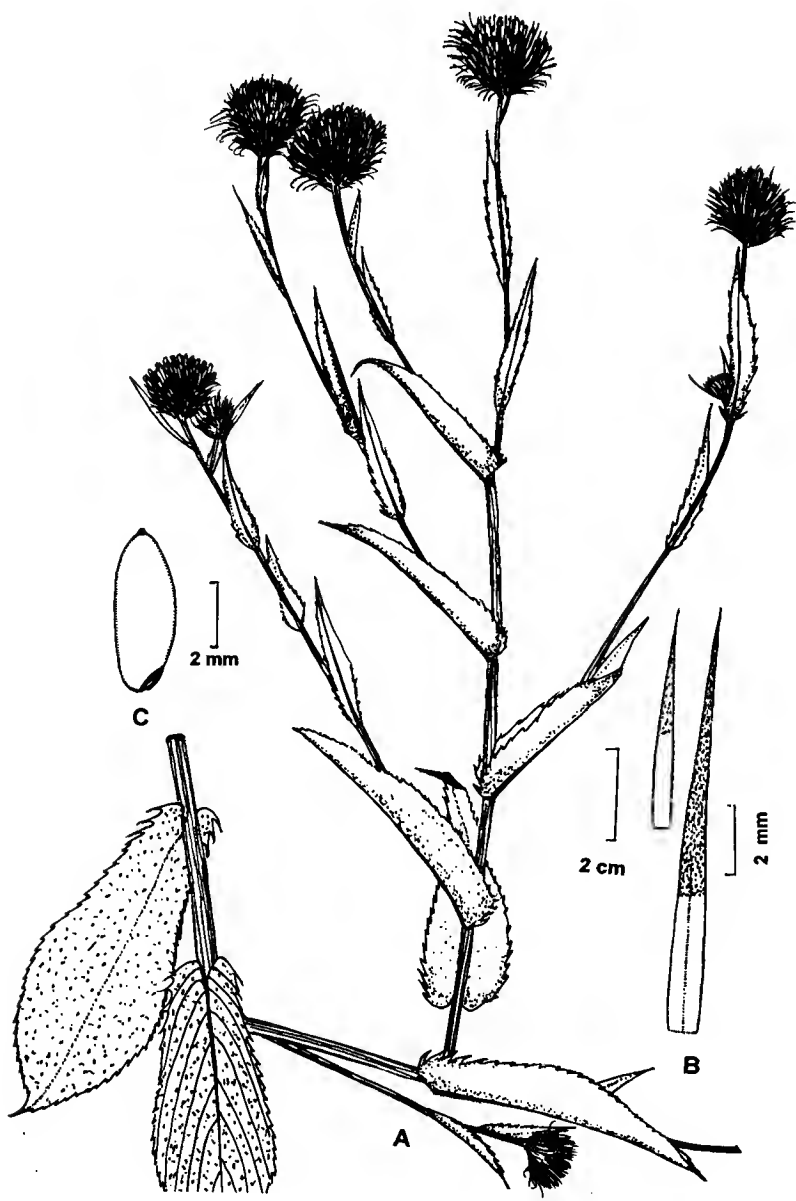


Fig. 1. *Tricholepis amplexicaulis* Clarke: A. Flowering twig; B. Phyllaries; C. Achene (from Sedgwick & Bell 4628).

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Tricholepis amplexicaulis is distinguished by its robust habit, amplexicaul leaf base, long deflexed phyllaries, and smooth achenes without pappus.

Specimens examined : INDIA, Kerala: Kasaragod Dist., Periyar, 200m, 2. 10. 1982, *Ansari* 74449 (CAL). Karnataka: Canara, Mysore, *Law* s. n. (CAL). Maharashtra : Bombay state, Khandala (Poona), 24. 11. 1957, *S. D. M.* 30756 (CAL); Khandala, St. X. Villa, 22. 10. 1942, *Santapau* s. n. (K); Poona, 12. 10. 1956, *Jain* 7647 (CAL); Bombay State, Bhoma hill, 11. 4. 1956, *Jain* 8906 (CAL); Bhimashannar, 30. 3. 1957, *Puri* 12624 (CAL); Thana, Kedarnath, 17. 11. 1968, *Billore* 115586 (CAL); Mahabaleshwar, Lingmalla, 4000 ft., Nov. 1918, *Sedgwick & Bell* 4628 (CAL, K); "Malabar, Concan", *Stocks, Law & C.* s. n. (CAL); "Concan", *Stocks* s. n. (K); Mahabaleshwar, 19. 10. 1906, *Ryan* 1463 (BM). On way to Jangli Jaigad, 23.11.1978, *Kodhar* 157795 (BSI); Foot of Rasacha mal near Godad (Khed taluka), 5.12.1961, *Janardhanan* 76258 (BSI); Top of Durga Khilla, about 20 meter west of Junnar, 12.1.1965, *Hemadri* 104399 (BSI); Dhak Forest, Junnar, 21.1.1966, *Hemadri* 108223 (BSI); Singbad, 12.11.1964, *Ansari* 101809 (BSI).

2. *Tricholepis elongata* DC., Prodr. 6: 563. 1838; Clarke, Compos. Ind. 239. 1876; Hook. f., Fl. Brit. India 3: 380. 1881; Collett, Fl. Siml. 276. 1971 (rep. ed.); Nair, Fl. Bashah. Himl. 168. 1977; Pandey & Chaudhary, Rheede 4:31f.1-7. 1994; Hajra in Hajra *et al.*, Fl. India 12:220, f.55.1995. (Fig. 2).

Tricholepis lanuginosa Klotzsch in Reise Pr. Wald. Bot. 79, t. 81. 1862.

Herbs, erect, 50-150 cm long, branched; branches slender, striate, sparsely to densely puberulous. Leaves 2.0 - 8.5 x 0.2 - 1.8 cm, subsessile, lanceolate or linear towards apex, cuneate at base, dentate to serrate along throughout margin or only along lower part of lower leaves, or pinnatifid in lower part and serrate to entire in upper part, acute with a spiny structure at apex, glabrous to minutely puberulous above, adpressed tomentose below, sometimes hairs adpressed on both surfaces, smooth to rough due to presence of raised points on upper surface, lateral veins and midrib raised below and puberulous. Heads 2 - 3 cm in diam., terminal, solitary, erect or slightly curved, ovoid, subtruncate at base; phyllaries 5 - 13 x 0.8 - 1.0 mm, unequal, shorter in outer whorls, longer in inner whorls, outer phyllaries narrowly ovate with more acuminate tip, glabrous, upper portion black (in dried specimens); middle phyllaries linear oblong with very linear tip, glabrous except tip portion, black and deflexed towards tip; inner phyllaries linear oblong with acuminate tip, glabrous towards base, pubescent towards apex, black towards tip. Corolla pale yellow, ca. 22 mm long, 5-lobed, each lobe 6 mm long; anther filaments papillose-hairy; style bifid at apex, longer than stamens. Achenes 4 x 1.5 mm, oblong, slightly narrower towards base, oblique at base, truncate at apex, smooth, glabrous; pappus 4 - 20 mm long, unequal, shorter in outer whorls, deciduous, connate at base, filiform, slightly broader towards base, barbellate.

Types: "India orient ad Kamaon", *Wallich* s.n. (Syntype, n.v., microfiche !); "Bengal", *Belanger* s.n. (Syntype, n.v.).

Phenology: Flowering from July through October.

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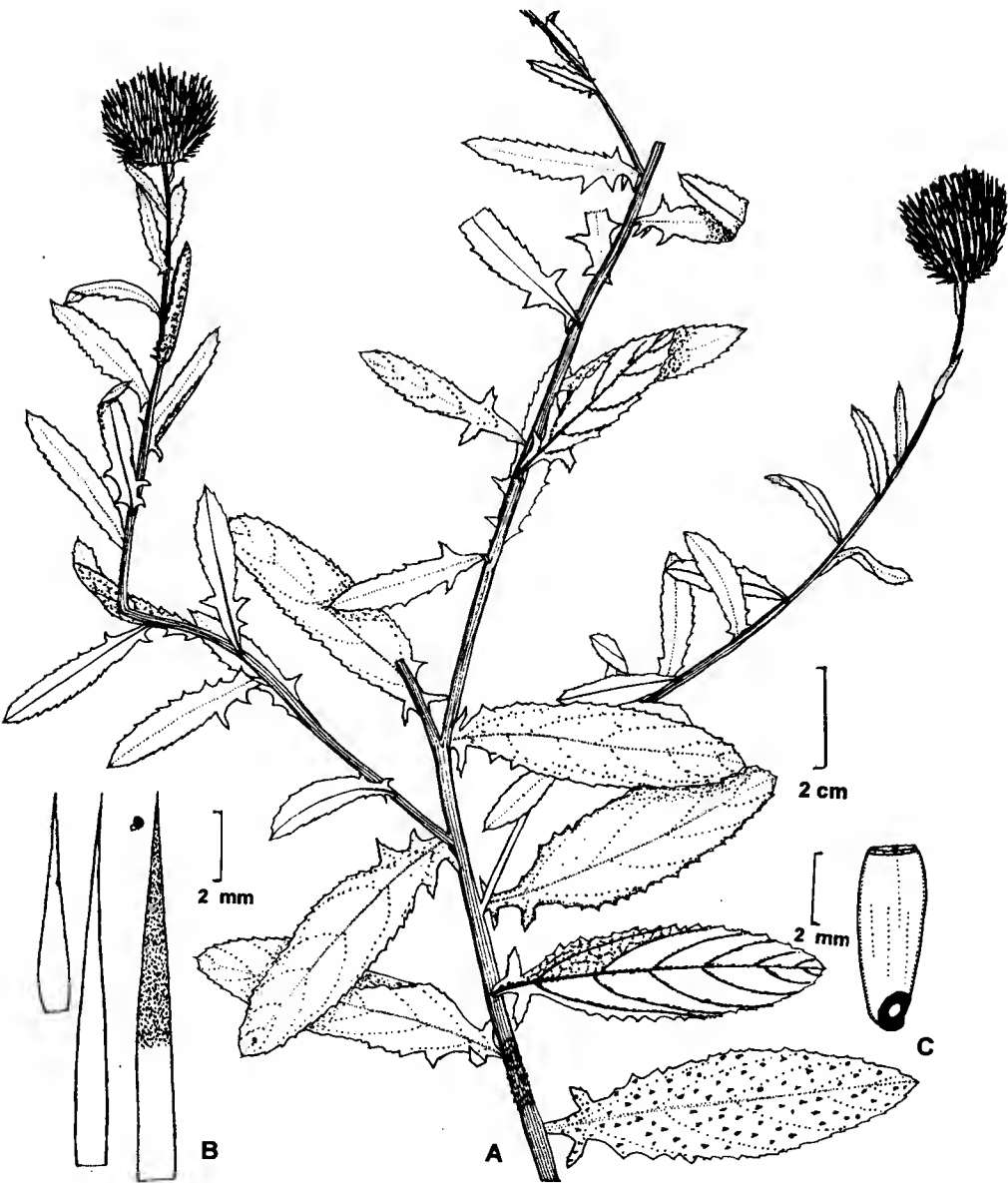


Fig. 2. *Tricholepis elongata* DC.: A. Flowering twig (from Hooper 39029); B. Phyllaries (from Polunin et al. 5406); C. Achene (from Thomson s.n.).

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Distribution: India (Himachal Pradesh, Jammu & Kashmir, Uttar Pradesh), Pakistan, Nepal; in grassy open slopes; alt. 4000 - 10000 ft.

Note : It is a common species in the Himalayas, distributed from Pakistan to Nepal. However, Dhar and Kachroo (1983) have wrongly cited that it is endemic to Kashmir. Pandey and Chaudhary (1994) for the first time reported it from Nepal.

Specimens examined : INDIA, **Himachal Pradesh:** Shimla, Mahasu road, 7200 ft., 22. 9. 1877, *Gamble 5340 B* (CAL), 5340 A (DD); Shimla, 6500 ft., 20. 9. 1876, *Gamble 1424 A* (K); Shimla, 7000 ft., Oct. 1878, *Gamble 6583 A* (K); Shimla, 9 km to Solan, 54 km to Kalka, 1447 m, 15. 10. 1977, *Anon. 2950* (CAL); Shimla, Fago road, 8000 ft., Aug. 1940, *Raizada 10087* (DD); Shimla, 4 - 7000 ft., 1844, *Edgeworth 180* (K); Shimla, 6000 ft., Sept. 1885, *Collett 664* (K). Below Phagu Giri, 7000 ft., Nov. 1877, *Collett 5387 A* (K); Solan - Shimla, 11. 10. 1984, *Hajra 76806* (BSD); Sarahan R. H., 1700 m, 6. 9. 1974, *Vohra 54282* (BSD); Mahasu Dist., between Jeori and Sarahan, 1500 m, 27. 8. 1963, *Nair 29931* (BSD). Riwalsar, 23. 8. 1977, *Murti & Prasad 62012* (BSD); Jungtoo, Rampur, 23. 3. 1963, *Nair 29831* (BSD); Shimla, 5 - 8000 ft., *s. d.*, *Thomson s. n.* (CAL, K); Chamba, Sao, 5000 ft., 7. 10. 1874, *Clarke 2358 A, B* (CAL); Chamba, Sao, 4000 ft., 6. 10. 1874, *Clarke 23496 C* (CAL); Chamba (Panji), between Re and Thaudal village, 8000 ft., 20. 8. 1899, *Harsukh s. n.* (CAL); Chamba, between Tisa and Abvas, 5-7000 ft., 28. 8. 1896, *Gammie 18279* (DD); Theog, 7000 ft., Oct. 1899, *Gamble B* (CAL, DD); Dalhousie, 7000 ft., *Grant 13* (CAL); Dalhousie, 1879-80, *Drumond 445* (DD); Dalhousie, Pentapotamica, 6 - 8000 ft., 1880, *Drumond 1843* (K); Shimla, 1884, *Drumond 444, 444 a* (DD); Kulu, Lahaul, *Drumond 22936* (K); Bashahr, Barseri, 27. 7. 1890, *Lace 439* (CAL); N. W. Himal., Bhimtal, 5000 ft., Oct. 1905, *Meebold s. n.* (CAL); Chamoli Dist., Shitel-Sutol, 4. 9. 1989, *Hajra 87621* (BSD); Sutol-Shitel, 9. 9. 1989, *Hajra 87981* (BSD); Pandho, Beas valley, 700 m, 29. 7. 1970, *Bhattacharyya 40311* (BSD); Bilaspur Dist., Namhol-Bhadur Pen tope, *Lal 63177* (BSD); Brua Khud, Baspa valley, ca 2150 m, 21. 10. 1971, *Janardhanan 46651* (BSD); Raturang, near Saugla (Baspa valley), ca 2700 m, 20. 9. 1971, *Janardhanan 46100* (BSD); Kinnaur Dist., Sapni, Baspa valley, 1800 m, 19. 9. 1964, *Nair 33041* (BSD); Kinnaur Dist., Peo, above I. T. B. P. camp, ca 2400 m, 4. 10. 1971, *Janardhanan 46458* (BSD); Kinnaur Dist., Shongtong, Tangling, Khudnala, ca 1957 m, 6. 10. 1971, *Janardhanan 46472* (BSD); Kinnaur Dist., Tapri, 1500 m, 29. 8. 1963, *Nair 30051, 30060* (BSD); Sirmaur Dist., Shillai, 7. 8. 1986, *Karku 82236* (BSD); Upper Chenab, 1880, *Brillis 644* (K). **Jammu & Kashmir:** Pahalgam to Chandanulari, 2500 m, 25. 9. 1961, *Wadhawa & Vohra 229* (CAL); Pahalgam, 7500 ft., 6. 9. 1876, *Clarke 31129 C* (CAL); E. Kashmir, Budrawara, 4 - 10000 ft., Sept. 1965, *Stoliczka s. n.* (CAL); Kashmir, 6 - 9000 ft., *Thomson s. n.* (CAL, K); N. W. Himal., lunna valley, Oct. 1877, *Duthie 241* CAL; Gala, Kali valley, 16. 9. 1900, *Duthie 24558* (K); Loran across the river, 1500 - 2500 m, 17. 9. 1985, *Vohra & Naithani 78295* (BSD). **Uttar Pradesh:** Jaunsar, Oct. 1894, *Gamble 15078* (CAL, DD); Almora, Ganai, 20. 10. 1912, 3500 ft., *Hooper 39029* (CAL); Kumaon, Ghagar, 7500 ft., 14. 11. 1909, *Gill 325* (CAL). Kumaon, near Almora, Sept. 1875, *Anon. s. n.* (DD); Kumaon, Gala, Kali valley, 16. 9. 1900, *Inayat 24558* (DD); Nainital, 27. 7. 1900, *Inayat 24554* (DD); Kumaon, Khairna, Oct. 1876, *Davidson s. n.* (DD); Kumaon, Hardoe pass, 8000 ft., *Strachery & Winterbottom s. n.* (K); Tihri Garhwal, Ganges valley, 4 - 5000 ft., Sept. 1881, *Duthie s. n.*

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(DD); Ganges valley, above Barahath, 4 - 500 ft., 28. 9. 1881, *Duthie 1736* (DD); Tihri Garhwal, Jamuna valley, near Bari, 7 - 8000 ft., 1. 9. 1883, *Duthie 845* (DD); Garhwal, Gaurikund-Rambar, 2500 m, 25. 9. 1958, *Rau 8591* (CAL, BSD); Chakrata Forest Div., Mundali, 8600 ft., 20. 9. 1958, *Sahni 26704* (DD); Jaunsar, Konair-Mundali road, near Kharamba, 21. 9. 1936, *Raizada 7289* (DD); Chakrata Div. Kharamba, 8500 ft., 19. 9. 1943, *Raizada 18259* (DD); Kulu Div., Karol, 9000 ft., 13. 10. 1940, *Ram 13825* (DD); Almora, 5500 ft., *Strachery & Winterbottom 2* (BM); between Dhakuri to Jatoli, 3000m, Sept. 1995, *Chaudhary 101815* (LWG); Dharamshala, Sao Chamba, 5000 ft., 7. 10. 1874, *Clarke 23583 B* (BM). PAKISTAN: N. W. Himal., Hazara, Kangan valley, 24. 8. 1896, *Inayat 19695* (CAL); Shalkhala, Near Keran, Kishanganga Valley, 12. 9. 1956, *Jan Mohd 8* (BM). NEPAL: Near Gurjakhani, 8000 ft., 11. 9. 1954, *Stainton, Sykes & Williams 4355* (CAL, BM); Lete (S. of Tukucha), Kali Gandaki, 8000 ft., 16. 9. 1954, *Stainton, Sykes & Williams 7864* (CAL, BM); Near Hurikot, 10000 ft., 25. 9. 1952, *Polunin, Sykes & Williams 5406* (CAL); Pina (Ping) Near Ara, 8000 ft., 27. 8. 1952, *Polunin, Sykes & Williams 3046* (CAL).

3. *Ticholepis furcata* DC., Prodr. 6 : 563. 1837; Clarke, Compos. Ind. 238. 1876; Hook. f., Fl. Brit. India 3: 380. 1881; Kitamura & Gould in Hara *et al.*, Enum. Flow. Pl. Nepal 3: 47. 1982; Kitamura, Acta Phyt. Geobot. 24: 12. 1969; Hajra in Hajra *et al.*, Fl. India 12: 222. 1995 (Fig. 3).

Herbs, erect, branched, branches slender, faintly striate, glabrous. Leaves simple, alternate, subsessile, linear-lanceolate, lanceolate or oblanceolate, cuneate to attenuate at base, entire to serrate with puberulous hairs along margins, acute to acuminate at apex, glabrous to puberulous above, hairs confined only at veins on below, midrib and lateral veins raised below, scabrous or tomentose, almost smooth to rough above. Capitulum terminal, solitary, recurved, ovoid or suborbicular, truncate at base; phyllaries 2.0-24 x 0.7 mm, unequal, shorter in outer whorls, longer in inner whorls, filiform with broad base and reflexed in outer whorls, linear-oblong with long apex in inner whorls, sparsely to densely ciliate towards apex in outer whorls, densely hispid towards apex in inner whorls; pales filiform, glabrous. Corolla 23 mm long, lobes 6 x 0.6 mm; anthers 9 mm long, filaments 3 mm long, smooth; style 23 mm long, swollen at base, finely pubescent below apex, bilobed at apex. Achenes 4 x 1.5 mm, oblong, turgid above, subturgid below, truncate at apex, oblique at base, smooth, glabrous, dull brown; pappus 4.0 - 20 mm long, unequal, shorter in outer whorls, longer in inner whorls, connate at base, deciduous, linear, flat towards base, ciliate along margins with minute hairs.

Type : Nepal as Gossainthan, *Wallich s.n.* (Holotype, n.v., microfiche !).

Phenology : Flowering from June through September.

Distribution : India (Jammu & Kashmir, Sikkim), Bhutan, Nepal.

Ecology : Hill slopes, alt. 1525-3050 m.

Note : Dhar and Kachroo (1983) have mentioned that this species is endemic to Kashmir and Pakistan, however, it occurs also in Bhutan and Nepal. Hajra (1995) recorded this species from Himachal Pradesh and Uttar Pradesh, while no specimens were observed from these regions in the present study.

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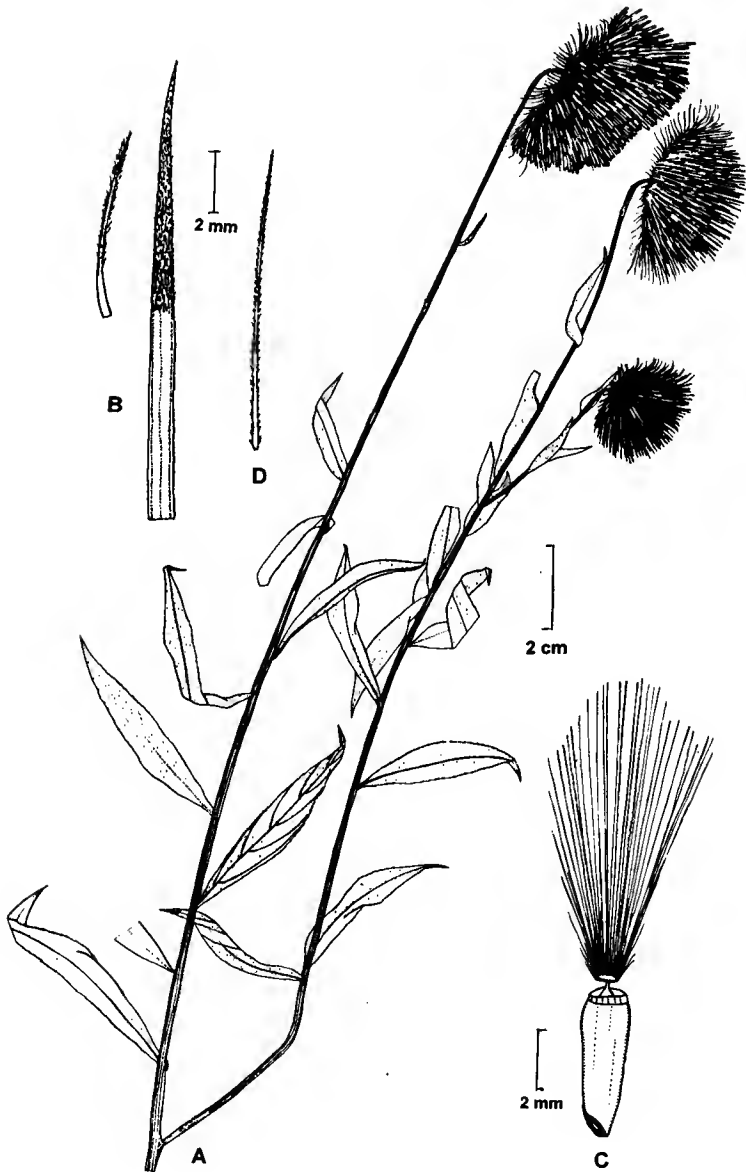


Fig. 3. *Tricholepis furcata* DC.: A. Flowering twig (from Gammie 1214); B. Phyllaries (from Hooker s.n.); C. Achene; D. Pappus (C & D from Ribu & Rhomoo 3079).

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Specimens examined : INDIA. **Sikkim**: Lachung valley, 7500 ft., 14. 9. 1892, *Gammie 1214* (CAL); Chungthang, Lachung, 7000 ft., Sept.- Oct. 1909, *Ribu & Rhomoo 3079* (CAL); Chungthang, 5000 ft., 25. 11. 1911, *Ribu & Rhomoo 6144* (K); Motithang, 2434 m, 8. 8. 1971., *Bedi 663* (K); Without locality, 5 - 10000 ft., *J. D. Hooker s. n.* (CAL, K). **Jammu & Kashmir**: Kashmir, between Pahlgam 7 Aru, 7500 ft., 24. 8. 1956, *Polunin 56/48 I* (BM). BHUTAN: Para, 8000 ft., 14. 11. 1914, *Cooper 3577* (BM) Without locality, Oct. 1935, *Anderson & Naskar 1003* (CAL). PAKISTAN: N. W. Himalaya, Hazara Dist., Kangan valley, 24. 8. 1896, *Inayat 19695* (K); Hazara, Deoli, 25. 8. 1899, *Duthie s. n.* (K); Murree hill, Changlagali, 7000 ft., 12. 9. 1918, *Stewart s. n.* (K); Changlagali, 3. 9. 1915, *Sunders s. n.* (K); Katha Piran, near Keran, Kishenganga valley, 14. 9. 1956, *Jan Mohd 26* (BM). NEPAL: Tiplung, Trishli, 5000 ft., Nov. 83, *Anon. s. n.* (K); Lower Marsyandi valley, 4000 ft., 30. 10. 78, *Anon. s. n.* (K).

4. *Tricholepis glaberrima* DC., Prodr. 6: 564. 1838; Dalz. & Gibs., Bombay Fl. 131, 315. 1861; Clarke, Compos. Ind. 240. 1876; Hook. f., Fl. Brit. India 3: 381. 1881; Gamble, Fl. Pres., Madras 2: 511. 1957 (rep. ed.); Duthie, Fl. Upp. Gang. Pl. 1 : 441. 1960 (rep. ed.). Santapau, Rec. Bot. Surv. India 16:136.1967; Chaudhary & Pandey, Rheede 4: 43, f. 2n-c.1994; Hajra in Hajra *et al.*, Fl. India 12: 222.1995.

Erect herbs or shrubs, 35 - 150 cm high, branches slender, terete towards base, angled towards apex, almost smooth, glabrous. Leaves 2.0-10.5 x 2.0-4.5 cm, simple, sessile, alternate, elongated-linear or linear-lanceolate, lanceolate, oblong, obovate or ovate, cuneate or subamplexicaul at base, entire to serrate along margin, subacuminate at apex in lower leaves, aristate in upper leaves, punctate, glabrous, very minute hairs present below on veins and along margins, veins obscure, occasionally lateral veins and midrib raised below. Capitulum 1.0 - 2.5 x 0.6-2.5 cm, terminal, oblong, obovate or ovate, subobtuse at base; peduncles 0-3 cm long, angled, glabrous; phyllaries 4-15 x 1 mm, subequal, shorter in outer whorls, appressed, erect or sometimes subdeflexed at tip, narrowly-ovate (in outer whorls) to oblong or narrowly lanceolate with caudate tip, glabrous or glabrous in outer whorls and finely pubescent in inner whorls. Corolla red or lilac, 11 mm long, lobes 3 mm long. Stamen 7 mm long; filaments pappilose-hairy; style 9 mm long. Achenes 4 - 5 x 1.5 mm, oblong, flat, smooth or very faintly striate, glabrous, yellowish-brown, with or without pappus; pappus minute to 2 mm long.

4a. *Tricholepis glaberrima* var. *glaberrima* (Fig.4 A-C)

Phyllaries glabrous in outer whorls and finely pubescent in inner whorls.

Type : "India Orientali Circa, Bombay", *Roxb. s.n.* (Holotype, *n.v.*, microfiche !).

Phenology : Flowering from September through November.

Distribution : India (Goa, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan) - endemic.

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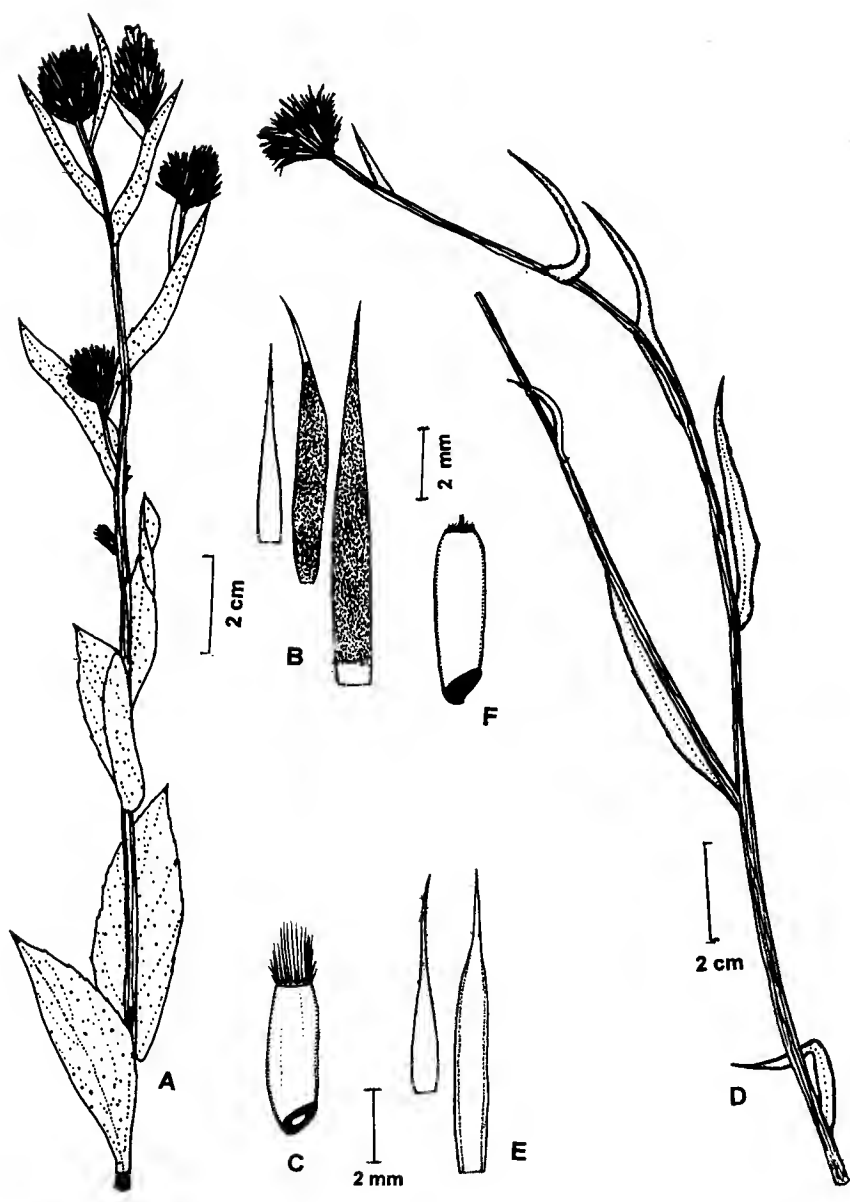


Fig. 4. A-C. *Tricholepis glaberrima* var. *glaberrima*: A. Flowering twig; B. Phyllaries; C. Achene (from Law s.n.); D-F. *Tricholepis glaberrima* var. *angustifolia* (DC.) Chaudhary et Pandey. E. Phyllaries; F. Achene (from Anon 2419).

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Ecology : Found in waste lands near cultivated fields among grasses, near sea shore, on rocky hill slopes; alt. 900-1200m.

Specimens examined: INDIA, **Goa:** Tudal, 11.10.1964, *Raghavan 103519* (BSI); Rajbhawan forest area, 17.11.1963, *Rao 2815* (BSI); Patim, 14.11.1962, *Rao 84754* (BSI); Natravali, Alduna, 14.10.1970, *Singh 125428* (BSI). Gujarat: Saurashtra, Sasan north towards Vasadhal hill, 1790 ft., 8. 10. 1953, *Raizada 23726* (DD). **Karnataka:** N. Canara, 27.II.1889, *Talbot 2136* (CAL); N. Kanara, Carwar, 20. 9. 1885, *Talbot 1323* (CAL); N. Kanara, *Clarke 1323* (K); S. Canara, Sambagi, 10.11.1900, *Barber 2308* (CAL); Karwar, Oct. 1919, *W.S. 6681* (CAL). **Madhya Pradesh:** Mando Dist., Sonagarh, Neel Kanth forest area, 13.11.1984, *Raizada et al., 13180* (LWG). **Maharashtra :** Bombay, Dharwar, 7.10.1950, *Dhruna 110* (CAL); Bombay, Ankola, 26.11.1949, *Dhruna 60* (CAL); Bombay Presidency, Mahd Island, 20.10.1945, *Sinclair 4551* (CAL); Bombay, Poud, 19.10.1956, *S.K.J. 7672* (CAL); Concan, *Law s. n.* (CAL, K); Western Ghats, 1884, *Cooke 108* (CAL); Thana, Sawa range (Chalani forest), 23.10.1967, *Billore 113203* (CAL); Thana, Ajoba hill, 17. 10. 1967, *Billore 111965* (CAL); Poona Dist., on way to Pandongan hill, 20. 12. 1963, *Reddi 93148* (CAL); Poona Dist., near Valwan dam - Lonavala, 29.9.1964, *Reddi 19191* (CAL); Saurashtra, Sasan north towards Vasadhal hill, 1790 ft., 8. 10. 1953, *Raizada 23726* (DD); Khandala, St. X. Ravine, 20.I.1945, *H. S. 5809* (K). **Rajasthan:** Mt. Abu, Sept. 1868, *King s. n.*, (CAL); Mt. Abu, 12.10.1887, *Duthie 6658* (CAL, DD, K,B); Mt. Abu, Rajputana, 12. 10. 1887, *Duthie s. n.* (K); Mt. Abu, Rajputana, 4000 ft., 1888, *Gamble 21006* (K); M. Abu, 4000 ft., 28. 9. 1953, *Raizada 20694* (DD).

4b. *Tricholepis glaberrima* var. *angustifolia* (DC.) Chaudhary & Pandey, Rheede 4:45.1994. *Tricholepis angustifolia* DC., Prodr. 6: 564. 1838, excl. syn.; Clarke, Compos. Ind. 240. 1876; Hook. f. in Hook. f., Fl. Brit. India 3 : 382. 1881; Gamble, Fl. Pres. Madras 2: 511. 1957 (rep. ed.); Hajra in Hajra *et al.*, Fl. India 12 : 220.1995 (Fig. 4 D-F).

Leaves 2.0-8 x 0.2-3 cm, simple, sessile, alternate, elongated-linear or linear-lanceolate. Phyllaries glabrous.

Type : India Orient. ad mountes Travancorenses, *Wallich s. n.* (Holotype, n. v.; microfiche !).

Phenology : Flowering from October through January.

Distribution : India (Karnataka, Kerala, Rajasthan) -endemic.

Ecology : Wastelands at altitude 60-1200 m.

Note : Hooker f. (1881) observed achenes without pappus while minute pappus have been observed in all specimens examined in the present study.

Specimens examined : INDIA, **Karnataka:** S. Canara, Parappa, 200 ft., 19. 11. 1920, *Fischer 4519* (CAL); S. Canara, Jahlsur, 22. 11. 1900. *Anon. 2419* (CAL); Mysore, Shimoga,

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20.10.1905, *Anon. 7031* (CAL); Tellichery, Nov. 1909, *Meebold 12083* (CAL); Kanara Dist., Bhatkal, 23. 1. 1947, *Raizada 21075* (DD); Kanara div., 24. 1. 1947, *Raizada 21085* (DD).

5. *Tricholepis karensium* Kurz., J. Asiat. Soc. Bengal 41: 318. 1872; Clarke, Compos. Ind. 238. 1876 ("*karensis*"); Hook. f., Fl. Brit. India 3: 380. 1881; Kerr, Fl. Siam. Enum. II-3: 294. 1936; Kitamura, Acta Phytotax. Geobot. 24: 13. 1969; Koyama, Acta Phytotax. Geobot. 56: 63. 1981; Kumar & Balodi., J. Eco. Tax. Bot. 10: 365. 1987; Swami & Gupta, Ind. J. For. 11: 176. 1988; Hajra in Hajra *et al.*, Fl. India 12: 222. 1995 (Fig. 5).

Perennial, erect herbs or shrubs, 50-100 cm high, stem woody, terete with fine striations, branched, puberulous-tomentose or glabrous and sometimes densely wooly towards apex (in Indian specimens). Leaves simple, sessile or subsessile, alternate, 3.5-15 x 1.0-3.5 cm, lanceolate, linear lanceolate, linear oblong, or occasionally oblanceolate and ovate, elliptic or oblong (in Indian specimens), cuneate at base, serrate or serrulate in lower leaves, entire in upper leaves, acute to acuminate at apex, puberulous-tomentose both surfaces or puberulous-tomentose below and glabrous above or glabrous both surfaces and sometimes densely cottony below in young leaves (in Indian specimens), puberulous along margins, sometimes black dots present on both surfaces or only at below, lateral veins up to 10 pairs, midrib and lateral veins raised below, puberulous-tomentose. Capitulum 4-6 cm in diam., terminal, solitary, truncate at base, subtended by leaves; phyllaries 10-50 x 1.0 mm, unequal, smaller in outer whorls, multiseriate, spreading and incurved, filiform but broader towards base, sometimes curved at tip, densely ciliate except basal portion with upwardly spreading hairs. Corolla usually white, sometimes pale-white or purple-white, filament papillose-hairy. Achenes 9 x 2 mm, oblong, slightly curved at apex, oblique at base, multiribbed; pappus 1 - 15 mm long, unequal, shorter in outer whorls, multiseriate, filiform, ciliate, connate at base, persistent.

Type : "In collibus Karen provinciae Burmae inferioris, miserunt", *O'Riley et F. Mason s.n.* (Holotype, n.v.).

Phenology : Flowering from June through October.

Distribution: India (Jammu & Kashmir), Myanmar, China, Thailand.

Ecology: Growing in hills on rocky slopes in open dry places along road sides; at alt. 900-2600m.

Notes: Hajra (1995) has recorded this species from Himachal Pradesh. However, in the present study no specimens have been observed from this region. The Indian plants differ from the plants of Myanmar, particularly in hairiness of stem and shape of leaves and need further field study in both the localities to know the range of variation of the species.

Specimens examined: INDIA. **Jammu & Kashmir**: Trikuta hill, 12. 6. 1986, *Kumar 81497* (BSD); Udhampur Dist., Udhampur, 19. 10. 1986, *Swami 1032* (BSD); Sanjichat-Vaishnodevi, 29. 8. 1989, *Uniyal 77397* (CAL, BSD); 2 km before Vaishno Devi, 26.10.1995, *Ahuja s.n.* (LWG). MYANMAR: Toungoo Mountains, Youngeleen, Dec. 1959, *Brandis 777*

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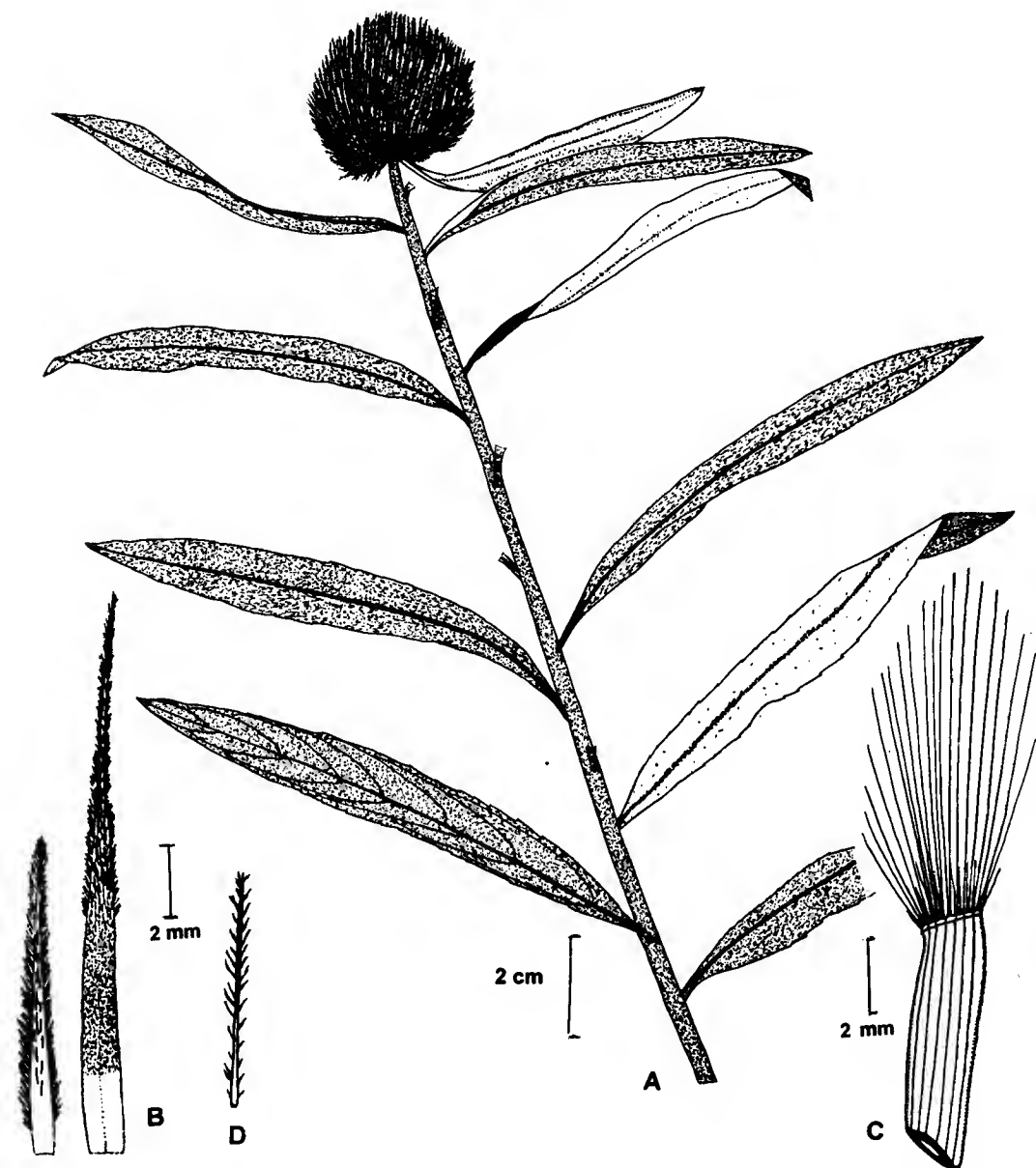


Fig. 5. *Tricholepis karensium* Kurz: A. Flowering twig (from *Khan 300*); B. Phyllaries (from *Huk s.n.*); C. Achene; D. Pappus (C & D from *Huk 139*).

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(CAL); Southern Shan States, 8. 3. 1917, *Annandale s. n.* (CAL); S. E. Shan States, 1890-91, *Fulton 10377* (CAL); Shan, Jan. 1891, *Huk s. n.* (CAL); Shan hills, Feb. 1892, *Huk 139* (CAL); Southern Shan States, 3000 ft., 24. 6. 1911, *Robertson s. n.* (K); Tongli (Pho), Nov. 1887, *Collet 10* (CAL); Maymyo Dist., 3000 ft., 28. 12. 1924, *Ingkau 250* (CAL, DD); Maymyo, Dec. 1888, *Khan 300* (CAL); Chin hill Dist., Haka, 8600', 2. 2. 1953, *Khant 2431* (CAL); Pakayo hills, 14. 2. 1901, *Prazer 36* (CAL); Karen hills, *Mason 13* (CAL); Karen, *Riley 185* (K). Amberst Dist., Mekane reserve, Feb. 1912, *Lace 6282* (K). THAILAND: Siam, Doi Sotep, 8. 1. 1911, *Kerr 1641* (CAL, K); Chiangmai, Doi Sotep, 1450 m, 1958-59, *Sorensen, Larsen & Hansen s. n.* (K); Northern Chiangmai, Doi Sotep, 1300 m, 4. 3. 1966, *Sukkri 35697* (K). Doi Chiangdao, 21. 10. 1931, *Anon. 4472* (K); Chiangdao, 1550 m, 29. 2. 1940, *Garrett 1157* (K); Chiang mai, Doi Chiang Dao, 1200 - 1600 m, *Anon. s. n.* (K); West of Bo Luang at km 53, 960 m, 2. 2. 1964, *Hansen, Seidenfaden & Smitinand s. n.* (K). CHINA, Yunnan: *Henry 265* (K); Yunnan, 4500 ft., *Henry 12688 A* (K).

6. *Tricholepis radicans* (Roxb.) Wight, Contr. Bot. Ind. 25. 1833; DC., Prodr. 6: 564. 1838 pp; Dalz. & Gibs., Bombay Fl. 131. 1861; Clarke, Compos. Ind. 240. 1876; Hook. f., Fl. Brit. India 3 : 381. 1881; Gamble, Fl. Pres. Madras 2: 726. 1921; Cooke, Fl. Pres. Bombay 2 : 114. 1958 (rep. ed.); Ramamoorthy in Saldhana & Nicols., Fl. Hassan Dist. 625. 1976; Rao & Razi, Synp. Fl. Mysore Dist. 549. 1981; Matthew, Mat. Fl. Tamil Nadu Carnatic 246 . 1981 & Fl. Tamil Nadu Carnatic t. 390. 1982; Rani & Matthew in Matthew, Fl. Tamil Nadu Carnatic 1 : 821, pl. 54 b. 1983; Chaudhary & Pandey, Rheedea 4 : 46, f.2D-F. 1994; Hajra in Hajra *et al.*, Fl. India 12:223.1995. (Fig. 6).

Carduus radicans Roxb., Fl. Ind. 3 : 408. 1832.

Annual erect herbs, 9-40 cm high, branches slender, terete towards base, angular towards apex, striate, glabrous. Leaves simple, sessile, alternate, 2.0-6.3 x 0.3-2.0 cm, spatulate towards base, oblong-obovate, oblong-ovate, oblong or linear towards apex, obtuse at base, toothed, serrate or pinnatifid along margin, teeth acute, mucronate or with a spine, rounded, subobtuse or acute with or without a spine at apex, glabrous with very minute hairs along margin, covered with raised points, veins obscure, or sometimes prominent below. Capitulum 1-2 cm, terminal, solitary, globose or conical, cuneate to rounded or occasionally truncate at base, homogamous; peduncles 1-3 cm long, slender, striate, glabrous; phyllaries 6.5-8.0 x 0.7-1.0 mm, unequal, multiseriate, imbricate, tightly appressed or reflexed at apex, stiff, linear subulate, linear to lanceolate, acuminate to more acuminate at apex, glabrous towards base, pubescent towards apex, ciliate. Corolla 9-11 mm long, pink, purple, red or blue, tube 5.5 mm long, narrowly cylindric, broadened above; lobes 5, each ca. 3 mm long, narrowly lanceolate, acute. Stamens 5; filaments ca. 1 mm long, papillose-hairy; anthers 4.3 mm long, linear with acute tip, sagittate. Ovary ca. 2 mm long, narrowly oblong; style ca. 9 mm long, shortly bifid; stigma terminal. Achenes 5 x 1.5 mm, oblong, subcompressed, closely ribbed, truncate at apex, oblique at base, glabrous, shining, yellowish-brown; pappus minute to 3.5 mm long, unequal, shorter in outer whorls, free, linear, flat, ciliate (fimbriate).

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Fig. 6. *Tricholepis radicans* (Roxb.) Wight: A. Flowering twig; B. Phyllaries (A & B from Patil 5784); C. Achene (from Rao 46852).

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Type : "In agro Maderaspatano", Wallich 2907 (Syntype, n. v., microfiche!).

Phenology : Flowering from September through December.

Distribution : India (Andhra Pradesh, Karnataka, Maharashtra, Tamil Nadu) - endemic.

Ecology : On the sides of paddy fields, in poorly dry, loamy and humus soils. Associated with grasses and Bajri crops; 30 - 1200 m.

Specimens examined: INDIA, **Andhra Pradesh**: Chittoor Dist., Mekalavani - Kunta, 400 m, 28. 12. 1975, Rao 46859 (CAL). Karnataka: Mysore, Oct. 1909, Meebold 11403 (CAL); Hassan Dist., Mysore, 1100 m, 4. 12. 1970, Saldanha & Ramamoorthy 1173 (K); Canara & Mysore, Law s. n. (K). **Maharashtra**: Bombay, Poona, Law college hill, 28. 8. 1956, J.A.V. 4838 (CAL); Bombay, Dalzell s. n. (K). Dongergaon, Ahmadnagar Dist., 2000 ft., Aug. 1919, Nana 6268 (CAL, K); Ahmadnagar, Dongergaon, Oct. 1891, Cooke 649 (K); Raghunath wadi, Alibag, 24. 11. 1957, Kamat 27019 (CAL); Dharwar, 2400 ft., Oct. 1919, Lqs 6619 (K); Malabar, Concan, Stocks s. n. (CAL); Bombay, Katraj ghat, 24. 8. 1956, Patil 5784 (CAL); Baramati, 9. 10. 1957, Kamat 27001 (CAL); Poona, University campus, 13. 9. 1960, Raghvan 64259 (CAL); Poona, College of Science, 1893, Anon. s. n. (DD). **Tamil Nadu**: Vedicherla, Nellor Dist., 90 ft., 21. 11. 1917, Fischer 4205 (CAL); Coimbatore, Hassanur, 3300 ft., 19. 12. 1905, Fischer 800 (CAL); Santaveri ghat Babab, 3500 ft., Oct. 1908, Meebold 9404 (CAL); Madurai, Nozannor, 10. 11. 1937, Bor 7579 (DD); Cuddapuh, 20. 10. 1939, Khusrain s. n. (DD); Bellary Dist., Tornagallu, 11. 8. 1901, Anon. s. n. (K); Nellore, Doravarichatram, 24.3.1901, Burkill 2180 (K); Dharmapuri, Denkanikotta taluk, Nagadonai village 9 km to Kelamangalam, 450 m, 16. 12. 1978, Mathew & Venugopal 20268 (K)

7. T. roylei Hook. f., Fl. Brit. India 3: 383. 1881.

Jurinea ? *Tricholepis* DC., Prodr. 6: 678. 1838. (Fig. 7).

Erect shrubs, stem leafy, densely cottony. Leaves 3-5 x 1.2-2 cm, subsessile, ovate or elliptic-lanceolate, cuneate at base, acute at apex, serrulate along margins, densely cottony below, glabrous with raised points above; petioles 3 mm long, densely cottony. Capitulum erect, solitary, terminal, 3-5.5 cm in diam., ovoid, subtruncate at base; phyllaries unequal, compactly arranged, deflexed towards tip; outer 5 x 1.5 mm, narrowly ovate, more acuminate, glabrous; middle ones narrowly ovate with aristate tip, glabrous; inner up to 25 x 1 mm, narrowly oblong, acuminate, glabrous below, densely pubescent towards apex. Corolla 3 cm long; staminal filaments papillose-hairy. Achenes not seen; pappus up to 14 mm long, persistent, unequal in length, shorter in outer whorls, longer in inner whorls, connate at base, filiform, broader towards base, barbellate.

Type : N.W. INDIA, Royle 88/649 (Holo: K !)

Phenology: Flowering from September.

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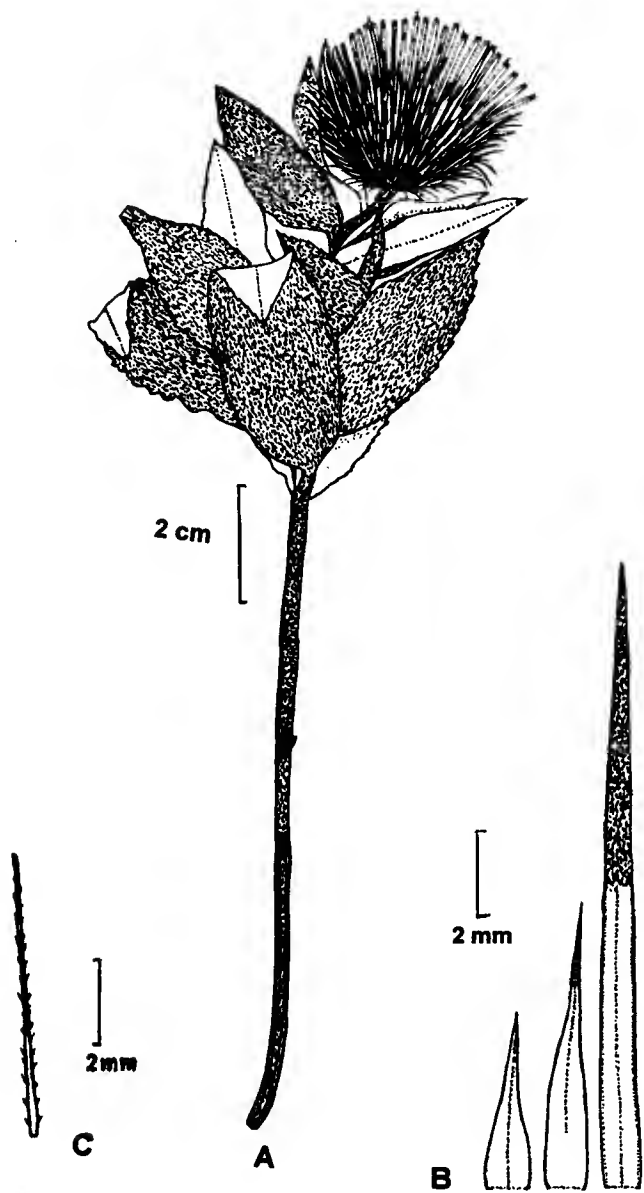


Fig. 7. *Tricholepis roylei* Hook. f.: A. Flowering twig; B. Phyllaries; C. Pappus (from Royle 992/26).

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Distribution: India (Himachal Pradesh), Tibet.

Ecology: On hill slopes at altitudes ranging from 1447-3600 m.

Note : It is a very distinct but poorly known species of the genus and can be easily identified by its cottony leaves and glabrous outer phyllaries. Only a few old collections of this species are available in K and DD and therefore, further collection of specimens, particularly in fruiting condition as well as field study are highly required to know more details of the species. Hajra (1995) has excluded this species from Indian flora.

Specimens examined: INDIA, **Himachal Pradesh:** Shimla, 9 km to Solan, 54 km to Kalka, 1447 m, 15. 10. 1977, *Van der Maesen 2950* (K); Suew (?), *Royle 992/26* (DD). TIBET: Upper chanelei valley, 12000 ft., Sept. 1938, *Gould 1569* (K).

8. *Tricholepis stictophyllum* Clarke, *Compos. Ind.* 241. 1876; Hook. f., *Fl. Brit. India* 3: 382. 1881; Duthie; *Fl. Upp. Gang. Pl.* 441. 1960 (rep. ed.); Haines, *Bot. Bihar & Orissa* 2:517.1961 (rep. ed.); Hajra in Hajra *et al.*, *Fl. India* 12:227.1995 (Fig. 8).

Perennial erect herbs, 4-35 cm high, sparingly branched from the base; stem short and woody, branches angular, grooved, glabrous or very minutely pubescent, terminating into a solitary head. Leaves 2-11 x 0.4-1.3 cm, simple, crowded at base, alternate and very sparse towards apex, sessile, linear or linear oblong, sometimes linear lanceolate or oblanceolate, half amplexicaul at base, entire or irregularly wavy or minutely serrulate with raised points along white margins, acute to acuminate at apex, surface rough to subsmooth, with or without raised points, glabrous; midrib raised below, lateral veins not distinct or if visible then parallel to midrib. Capitulum 15 - 30 cm in diam., solitary, terminal, ovoid, obtuse or truncate at base; peduncles 3.0 - 12.5 cm long; phyllaries unequal, outer 4.5 x 2 mm, ovate, acuminate, thick, smooth, glabrous or very minute hairs present along margins near tip; inner up to 11 x 4 mm, linear oblong with caudate erect flexous tip, glabrous below, pubescent towards apex; pales 7 - 10 x 1.8 mm, membranous, sometimes 2-3 lobed, glabrous. Corolla purple, 15-16 mm long, lobes 4.5 mm long. Stamens 8 mm long; filaments 2 mm long, papillose-hairy. Ovary 2 mm long; style 16-17 mm long; stigma bifid. Achenes 5.5 x 1.5 mm, oblong, turgid, distinctly many-ribbed, not shining, oblique at base, truncate at apex, glabrous; pappus up to 14 mm long, unequal, shorter in outer whorls, longer than phyllaries, filiform, feathery.

Type : Saharanpur (Province Agra), *Edgeworth s. n.* (Syntype, *n.v.*); Central India, Saugur, *Jerdon s. n.* (Syntype: CAL !).

Phenology: Flowering from March through May.

Distribution: India (Bihar, Orissa, Uttar Pradesh, Madhya Pradesh), Myanmar.

Ecology: In open places of *Shorea* forests, alt. 7000 m.

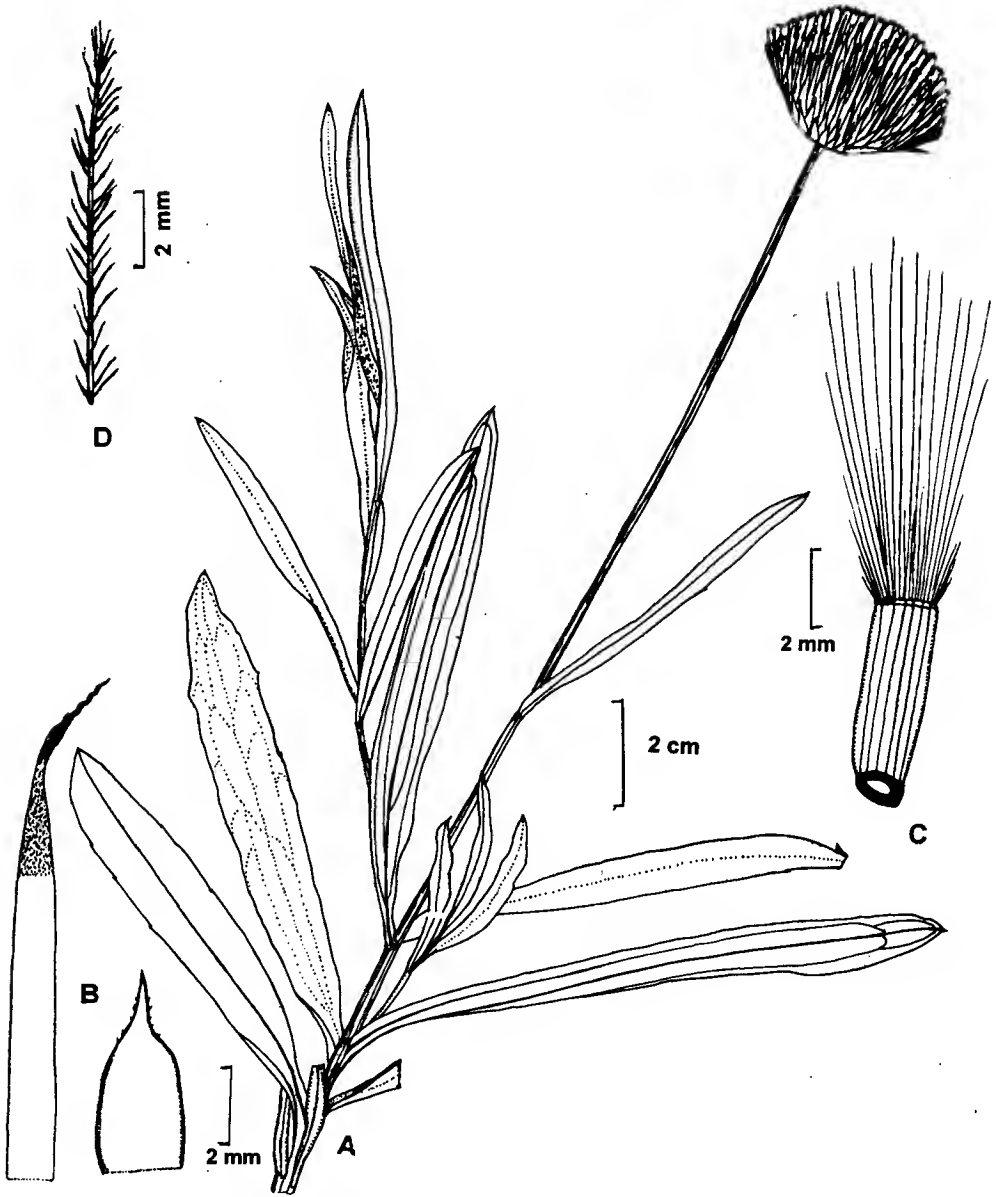
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Fig. 8. *Tricholepis stictophyllum* Clarke: A. Flowering twig; B. Phyllaries (A & B from *Jerdon s.n.*); C. Achene; D. Pappus (C & D from *Harshukh 22253*).

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Specimens examined: INDIA, Bihar: Part of Chhota Nagpur, 30. 5. 1918, *Haines 4384* (CAL); Topla, May 1912, *Haines 3342* (K); Uttar Pradesh: Upper Gangetic plain, Gorakhpur, Nagura forest, 20. 4. 1898, *Harsukh 22253* (CAL, DD); Upper Gangetic Plain, Kheri Dist., Garah, Pilibhit, 30. 5. 1898, *Inayat 22254* (CAL, DD); Bahraich (Oudh), Chakia, 15. 4. 1900, *Inayat 23682* (CAL, DD); Kheri (Oudh), Ambara, 10. 4. 1898, *Inayat 22253 b* (CAL, DD, K), *22253 a* (DD), *22253* (K); Pilphit, 6. 5. 1898, *Duthie s. n.* (K); Pilibhit, Mala, 18. 5. 1970, *Malhotra 37138* (CAL); Latipur Dist., Chandan Chola, 23. 4. 1964, *Malhotra 31553* (BSD); Dehra Dun, Mothronwala, 700 m, 25. 11. 1958, *Dakshini 8798* (BSD); Dehra Dun, Mothronwala, 700 m, 27. 6. 1958, *Dakshini 5540* (DD). Madhya Pradesh: Verosimilater, *Jerdon s. n.* (CAL). Pachmarhi, Oct. 1911, *Haines s. n.* (K). Orissa: Sambalpur, Kawardha, east of Nandi 2100 ft., 3. 3. 1940, *Mooney 1272* (DD, K). MYANMAR: Upper Burma, 1887, *Collett 425* (CAL); Sindawng hill, 3 - 3500, 6. 3. 1917, *Annaudale 490* (CAL); Phan hill Matear, 5000 ft., Feb. 1884, *Collett 424* (K).

9. *Tricholepis tibetica* Hook. f. & Thomson in Clarke, Compos. Ind. 241. 1876; Hook. f. in Hook. f., Fl. Brit. India 3: 382. 1881: Hemsley in Hook., Icones Pl. 18: pl. 1732. 1888; Lincz., Not. Syst. Leningrad 16:482, f.1. 1954; Kitamura, Fl. Afghanistan 452.1960; Stewart in Nasir & Ali, Fl. W. Pakistan 798.1972. Rechinger in Rechinger, Fl. Iranica 139b:307.1980; Hajra in Hajra *et al.*, Fl. India, 12:224.1995; Chaudhary, J. Econ. Tax. Bot. 22:229.1998 (Fig. 9).

Herbs, 25 - 60 cm high, erect, profusely branched from the base; stem and branches slender, terete, almost smooth, minutely pubescent to glabrous, branches terminating into a solitary head. Leaves up to 4 x 0.2 cm, simple, sessile, fleshy, linear oblong, linear oblanceolate or linear; pinnatifid along margin in lower leaves, entire in upper leaves, lobes of pinnatifid ones few, spreading or recurved, triangular with acute tip, acute at apex, glabrous; veins obscure, surface rough with raised points. Capitulum 2 x 1 - 2 cm, ovate, obovate or subglobose, terminal, erect, solitary, acute, truncate or obtuse at base; phyllaries 1 - 12 x 0.5 - 1.0 mm, unequal, shorter, ca. 1 mm long, in outer whorls, longer, ca. 12 mm in inner whorls, tightly appressed, thick, ovate-subulate in outer whorls, narrowly lanceolate in inner whorls, acuminate, glabrous in outer whorls, pubescent towards apex in inner whorls. Corolla pink, 13 mm long, lobes 4 mm long. Stamens 7.5 mm long; filaments 1.5 mm long, pubescent. Style 12 mm long, filiform, glabrous; stigma bifid. Achenes 2.5 x 0.8 mm, oblong, compressed, almost smooth, not shining, brown, truncate at apex, oblique at base; pappus unequal, minute to 6.5 mm long, shorter in outer whorls, longer in inner whorls, multiseriate, free, linear, persistent, minutely pubescent and ciliate.

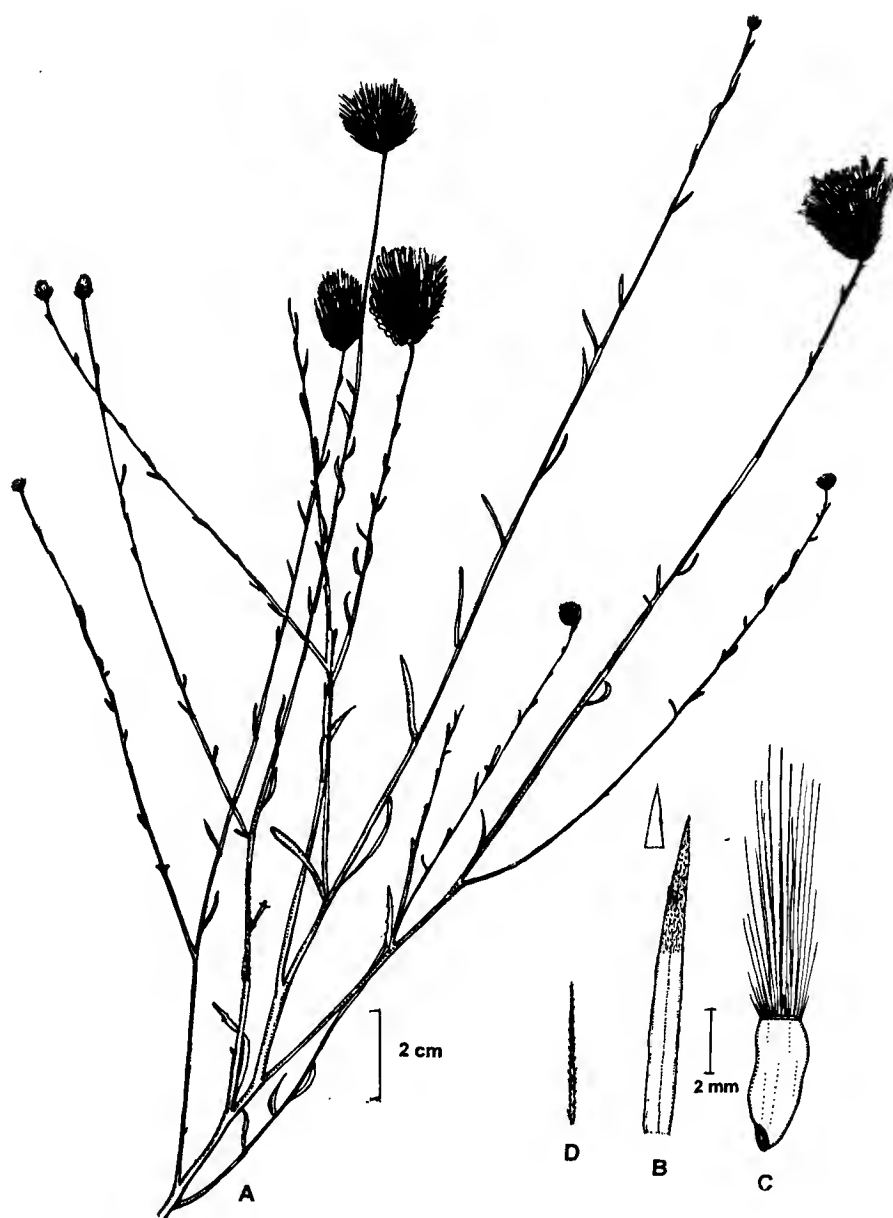
Type : "Himalayae boreali-occidentalis, Nubra, 10000 - 12000 ft", October, *Thomson s. n.* (Holotype : K, Isotype: CAL !).

Phenology: Flowering from July through October.

Distribution: India (N. Kashmir), Pakistan, Afghanistan, W. Tibet.

Ecology: On dry slopes under boulders, rocks; alt. 1800-3600m.

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Figs. 9. *Tricholepis tibetica* Hook. f.: A. Flowering twig (from Chowdhery & Uniyal 86010); B. Phyllaries (from Stewart 20478); C. Achene (from Giles s.n.); D. Pappus (from Beg 1602).

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Specimens examined: INDIA, Jammu & Kashmir: Nubra, 10-1200 ft., 25. 10 1844, Thomson 2205 (CAL); Nubra 10 - 1200 ft., Thomson s. n. (CAL); Nubra, Shaqur valley, 25. 2. 1847, Thomson s. n. (K); Gilgit, Manu gam nala, 9000 ft., Thorneley 34 (BM); Gilgit, 1885, Giles s. n. (CAL, DD); Gilgit expedition, S. of Hindu Kush, 7000 ft., Giles s. n. (K); Gilgit, Maiyun Hunza, 7000 ft., 9. 8. 1954, Stewart 26367 (DD); Gilgit road, Deosai plain, Baltistan and Ladakh, Skardu to Shigar, 8000 ft., 7. 8. 1940, Stewart 20478 (CAL, DD); Baltistan, Shagathang valley, 8 - 9000 ft., 18. 7. 1892, Duthie s.n. (K); Skardo, Baltistan, 7700 ft., 4. 8. 1876, Clarke 30042C (CAL), 30042 (K) ; Satpura Nullah above Skardu, 8 - 9000 ft., 3. 8. 1940, Stewart 20274 (DD); Baltistan, Satpura Nullah above Skardu, 8 - 9000 ft., 14. 7. 1892, J.D. Hooker 12043 (DD); Baltistan, Hagarthang valley, 8 - 9000 ft., 18. 7. 1892, J.D. Hooker s.n. (DD); Aster valley, 7 - 8000 ft., 26. 7. 1892, J.D. Hooker s. n. (DD); Iltar valley, north of Gilgit, 6 - 7000 ft., 3. 8. 1892, J.D. Hooker s. n. (DD); Pulandar Ladakh, 9 - 10000 ft., Aug. 1905, Meebold 1178 (CAL); Ladakh, between Batalik and Bema, 3. 8. 1988, Chowdhery & Uniyal 86010 (BSD).

Note : *Tricholepis tibetica* is recognised by its narrow leaves. Generally, the tip of outer whorls of phyllaries is acuminate while the specimen from KaraKoram, C.B. Clarke 30095 A (CAL) of which Clarke identified as *T. spartoides* has aristate tip and more or less exhibits intermediate position between *T. tibetica* and *T. chaetolepis* and needs further study after collecting more plants. Among Indian species *T. toppinii* alone has narrow leaves, but it differs by its globular noded heads and loosely arranged filiform outer phyllaries.

10. *Tricholepis toppinii* Dunn, Kew Bull. 1921: 217. 1921; Lincz., Not. Syst. Leningrad 16:483, f.1. 1954; Rechinger in Rechinger, Fl. Iranica 139b:304, t.293. 1980; Chaudhary, J. Econ. Tax. Bot. 22:230. 1998. (Fig. 10).

T. spartoides auct. non Clarke 1876; Hemsl. in Hook., Ic. Pl. 18:t.1733. 1888.

Herbs, erect, ca. 45 cm high, profusely branched from the base; stem and branches slender, striate/ribbed or smooth towards base, leafy, glabrous, branches terminating into a solitary head. Leaves 10-40 x 1-8 mm, larger in lower part and gradually reducing in upper part, sessile, linear obovate, linear oblong, linear lanceolate or linear, cuneate at base; entire or serrate or pinnatifid at base in lower leaves along margins; acute (in lower leaves) to acuminate (in upper leaves) at apex, glabrous; veins not visible, midrib slightly raised below in lower leaves, surface rough. Capitulum 15-30 mm in diam., globular, terminal, solitary, rounded at base, noded; phyllaries 3-16 mm long, unequal, shorter in outer whorls, longer in inner whorls, multiseriate, loosely arranged/spreading; outer filiform, glabrous; inner linear oblong with long narrow tip, densely pubescent in upper part, curved at tips in inner whorls; in young capitulum all phyllaries form brush like structure. Corolla yellow, 2 cm long, 5-lobed, lobes 4-5 mm long, linear, obtuse. Anther base sagittate; filaments puberulous. Achenes smooth; pappus 12 mm long, connate at base, multiseriate, shorter in outer whorls, filiform, slightly broader towards base, barbellate.

Type : India. Kashmir, Ziarat, near Chitral, at 2700 m, Aug. 1909, *Toppin* 603 (Holotype: K).

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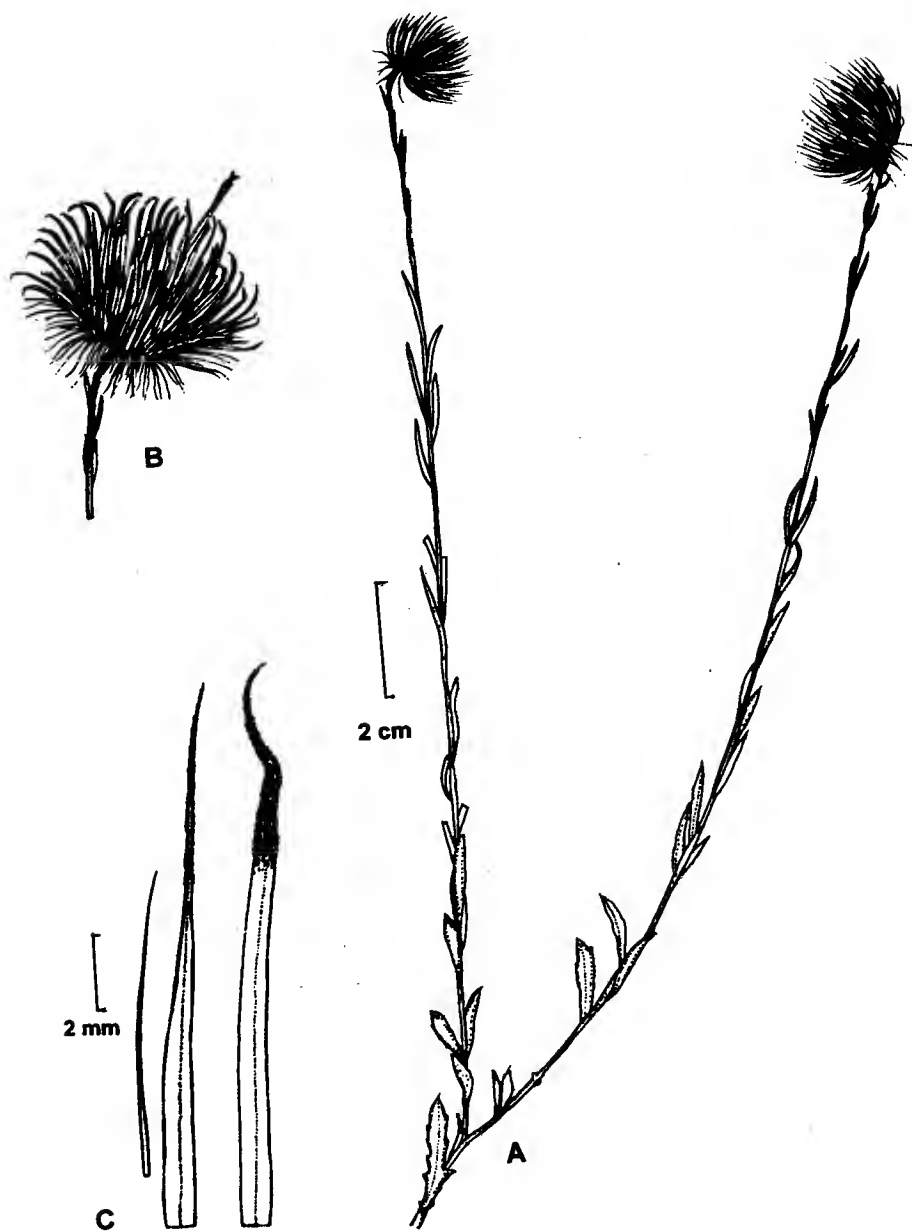


Fig. 10. *Tricholepis toppinii* Dunn: A. Flowering twig; B. Capitulum (from Giles s.n.); C. Phyllaries (from Beg 1602).

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Phenology: Flowering from June through July.

Distribution: India (Jammu & Kashmir), Pakistan.

Ecology: Growing at attitudes ranging from 2500-2700 m.

Note : *Tricholepis toppinii* was described by Dunn in 1921 based on Toppin's specimen collected from near Chitral. He differentiated it from *T. tibetica* by its dense, oblong papery leaves, noded capitulum, and long and subulate outer involucral bracts (phyllaries). But Stewart (1972) while working for *Flora of West Pakistan* reduced it as a synonym under *T. chaetolepis*. Chaudhary (1998) after critical study of *T. toppinii*, *T. chaetolepis* and *T. tibetica* by protologues and Type specimens, reinstated *T. toppinii* as a distinct species as done by Rechinger (1980).

Specimens examined: INDIA, Jammu & Kashmir: Gilgit, 1885, *Giles s. n.* (CAL, DD). PAKISTAN: Ziarat, Chitral, 29. 7. 1956, *Beg 1602* (DD, K); Ziarat, 7000 ft., 14. 6. 1895, *Coll. ? 16276* (DD, K); Chitral Dist. 1894, *Younghuushand s. n.* (DD); Chitral, ca 3500 m, 15. 7. 1950, *Wendelbo s. n.* (K); Chitral, Mastuj-Barghil track, 8000 ft., 19. 7. 1958, *Stainton 2933* (BM).

EXCLUDED SPECIES

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T. montana Dalz. & Gibs., *Bombay Fl.* 131. 1861.

T. nakaoi Kitamura, *Acta Phytotax. Geobot.* 19 : 105. 1963.

T. stewarti Clarke ex Hook.f. in Hook.f., *Fl. Brit. India* 3 : 380. 1881

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